10

FIG. 1

Decomposing images and objects
into an atomic element

12

Determining permutation instruction
for rearrangement of data in the
atomic element

14

16

Performing a sequence of the
determined permutation instruction

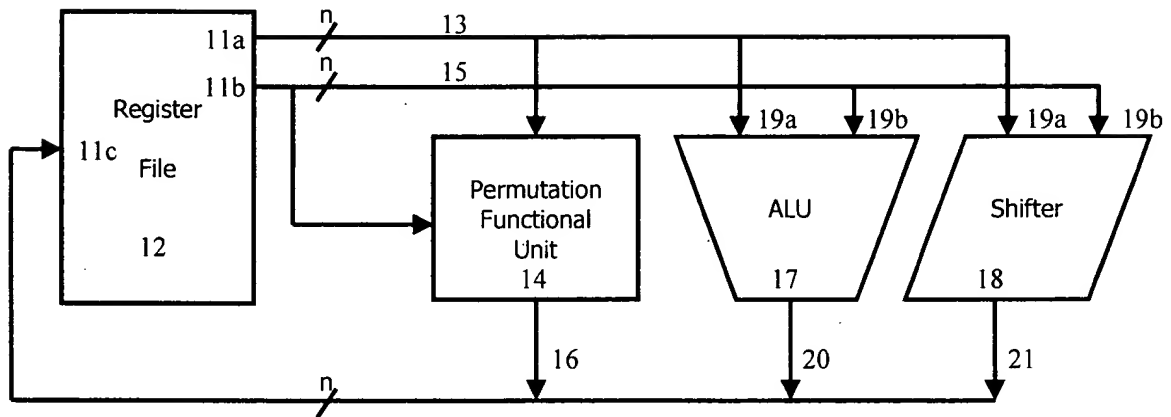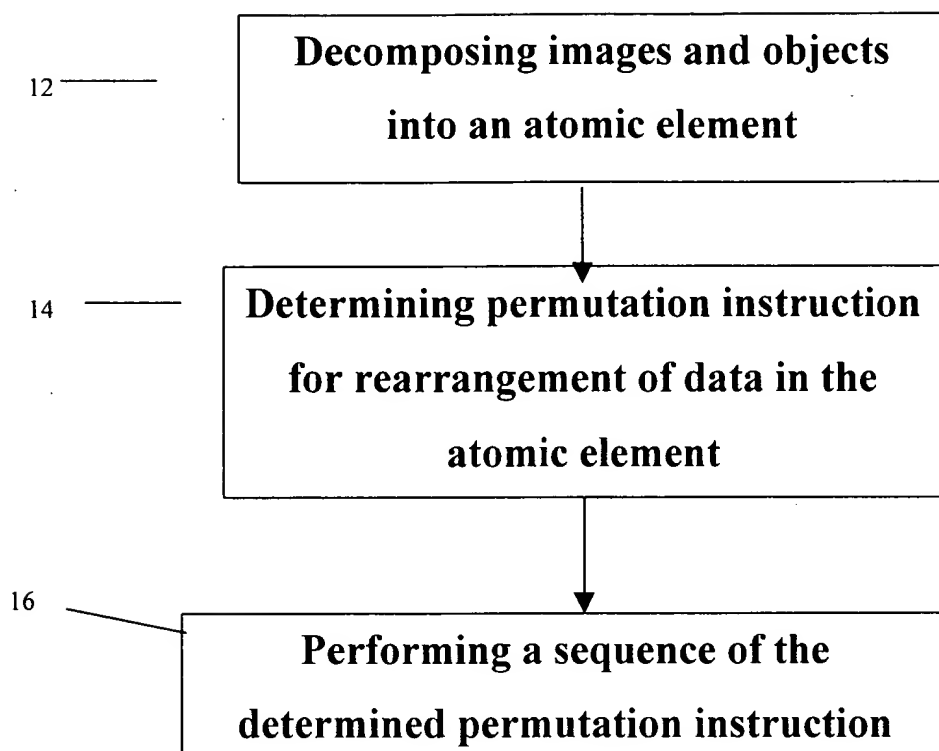**FIG. 2**

(a) Area mapping of a 4x4 matrix:

```
R1 =   a00   a01   a02   a03
R2 =   a10   a11   a12   a13
R3 =   a20   a21   a22   a23
R4 =   a30   a31   a32   a33
```

Fig. 3a

(b) Decomposition into four 2x2 matrices:

```
R1 =   a00   a01   b00   b01
R2 =   a10   a11   b10   b11
R3 =   c00   c01   d00   d01
R4 =   c10   c11   d10   d11
```
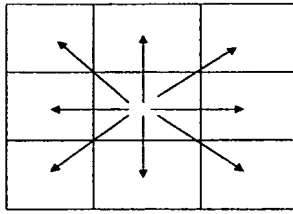
Fig. 3B

Fig. 4A

Fig. 4B

Identity

Up-down

Right-Left

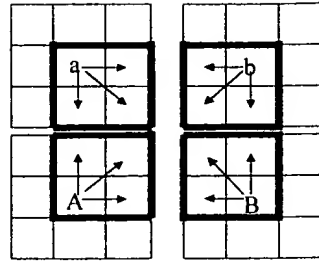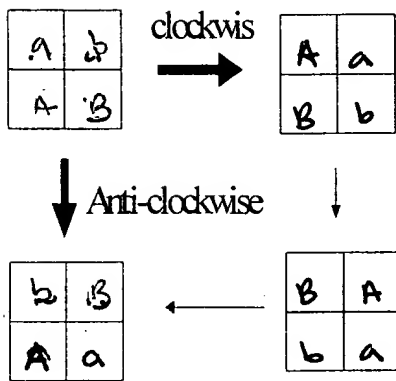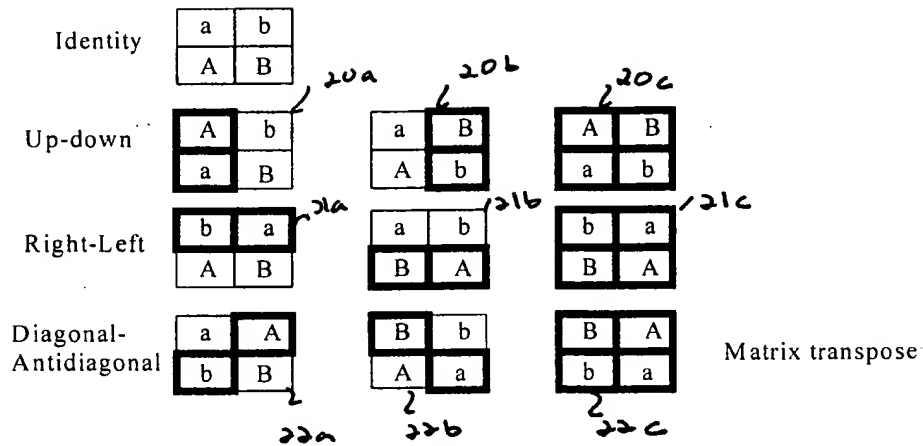Diagonal-Antidiagonal

Matrix transpose

Fig. 4C

clockwis

Anti-clockwise

Rotate by 2 elements = swap diagonal and antidiagonal elements

Fig. 5A

Fig. 5B

r1	a00	a01	b00	b01
r2	a10	a11	b10	b11
r3	c00	c01	d00	d01
r4	c10	c11	d10	d11

mixL,16 r1,r2, t1
mixR,16 r1,r2, t2
mixL,16 r3,r4, t3
mixR,16 r3,r4, r4

a00	a10	b00	b10	t1
a01	a11	b01	b11	t2
c00	c10	d00	d10	t3
c01	c11	d01	d11	r4

mixL,32 t1,t3, r1
mixL,32 t2,r4, r2
mixR,32 t1,t3, r3
mixR,32 t2,r4, r4

a00	a10	c00	c10	r1
a01	a11	c01	c11	r2
b00	b10	d00	d10	r3
b01	b11	d01	d11	r4
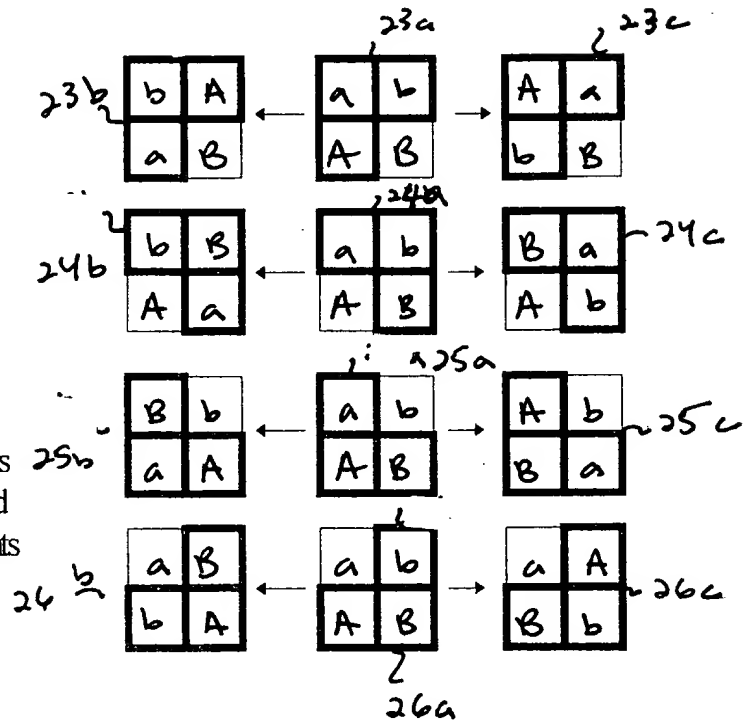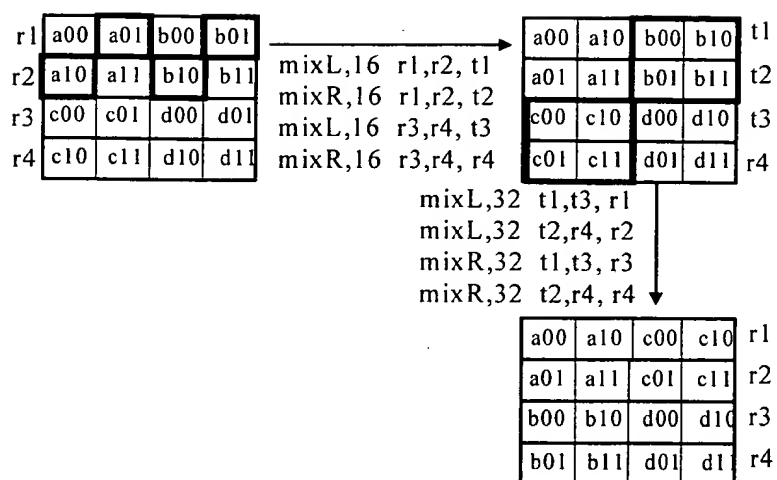
Fig. 6:

Identity

a	b
A	B

Changing Rows to Diagonals

b	A
B	a

B	a
b	A

Changing Diagonals to Columns

B	A
a	b

A	B
b	a

Figure7

Alphabet A:

mixL, mixR on 8, 16 and 32 bit subwords (or **cmixL, cmixR**)
check on 8, 16 and 32-bit subwords (or **ccheck**)
excheck on 8, 16 and 32-bit subwords (or **cexcheck**)
permset on 8, 16 and 32 bit subwords, with 4-element sets (or **cexchange**)

Fig. 8A

Alphabet B (minimal):

mixL, mixR on 8, 16 and 32 bit subwords (or **cmixL, cmixR**)
permset on 8, 16 and 32 bit subwords, with 4-element sets (or **cexchange**)

Fig. 8B